SHOWCASE PROJECT: UC IRVINE: SMART LABS INITIATIVE/NATURAL SCIENCES II

SOLUTION OVERVIEW

UC Irvine began the Smart Labs Initiative in 2008 as a crucial step towards making a sizeable reduction in the university's carbon footprint. Laboratories, which account for two-thirds of the energy consumed within Irvine's academic core, was an obvious place for the university to focus.

The Smart Labs Initiative has worked to make already energy-efficient buildings even more efficient, and utilizes a process that works on older and newer labs and new lab construction. This initiative, which is continuously upgrading buildings as technology improves, was part of a larger effort to meet the University of California's policy goal of reducing greenhouse gas (GHG) emissions system-wide to year 2000 levels by 2014 and to 1990 levels by 2020 as required by AB 32 (the California Global Warming Solutions Act) and UC's Sustainable Practices Policy.

Why do laboratories consume so much energy? In a word: ventilation. Laboratory buildings use 100 percent outside air ventilation (per code) with no recirculation of return air. The entire internal air volume of a typical lab building is exhausted to the atmosphere via high-velocity exhaust stacks every six to eight minutes. An enormous amount of energy is required to supply, heat, cool, humidify, dehumidify, filter, distribute, and exhaust this air, and this process – known as air-changes per hour (ACH) ? was taking place at least eight times an hour, 24 hours a day, seven days a week, whether the laboratory was occupied or not.

UC Irvine determined that with the right complement of technologies, the ACH could be reduced safely when conditions permit.

For more information, please click on the webinar below:

Smart Lab Buildings PDF 9mb

SECTOR TYPE

Education

LOCATION

Irvine, California

PROJECT SIZE

146,000 Square Feet

FINANCIAL OVERVIEW

Project Cost: $829,864, with utility incentive of $416,442

SOLUTIONS

The Smart Labs Initiative successfully challenged industry best practices. In 2005, UC Irvine facilities engineers took a skeptical look at what had been touted by developers as “smart building” technology: the use of occupancy sensors to turn on and off heating, ventilation and air conditioning (HVAC), as well as lighting. UC Irvine knew it could do better.

By 2008, the campus recognized that while modern laboratories employed direct digital controls and variable volume air delivery and exhaust, these systems had merely replicated the functions of the pneumatic systems that had been in use for 70 years, albeit with more precise control. Moreover, gains in energy efficiency design standards had plateaued.

In 2008, when the campus set out to cut its laboratory energy use in half – double the performance required under California Title 24 energy efficiency standards – the outcome was uncertain. Until recently, most attempts to improve laboratory energy efficiency had plateaued at 20-25 percent better than code. In order to make a major impact on its carbon footprint, UC Irvine set the savings goal much higher – 50 percent – challenging established best practices, and, if successful, raising the performance bar for all laboratories. The campus also set a binding requirement that these savings could not be achieved at the expense of safety.

The Smart Labs Initiative began in 2008, funded through $23.4 million in "Energy Bonds" issued by the university and $5.8 million in utility incentives, and has completed projects each year from 2008-2012. The initiative will continue to be funded going forward to continuously improve and update the laboratory buildings on campus. The energy bonds used to finance these projects are repaid with savings from the utilities budget at no additional cost to the university.

With the understanding that achieving the desired energy savings would take more than a single technology, UC Irvine’s Smart Labs Initiative integrated approach is designed to:

- Reduce the energy required to exhaust air from the building by reducing exhaust stack velocity (Typically 75% reduction)
- Reduce the energy required to provide heating, ventilation, and air-conditioning by reducing duct, fan, and filtration airspeeds and by removing resistive losses in the supply stream (Typically more than 50% reduction)

by integrating the following measures:

- State-of-the art air quality sensing
- Sharply reduced lighting power-density
- Efficient heat exhaust for equipment
- Elimination of energy-robbing HVAC acoustic attenuators

Natural Sciences II focused on the following measures:

- Office wing static pressure reset (savings of 26,317 kWh/year)
- Exhaust stack discharge velocity reduction (savings of 918,410 kWh/year)
- Centralized demand controlled ventilation (savings of 340,839 kWh/year and savings of 31,622 therms)
- Lighting retrofit (savings of 111,634 kWh/year)
- High-bay lighting retrofit (savings of 13,266 kWh/year)

OTHER BENEFITS

The Smart Labs Initiative has led to a number of ongoing operational benefits for all of the participating labs, as well as awards and recognition for individual buildings.

Additional benefits from this showcase project include:

- Deferred maintenance - Replacing aging, worn, or neglected systems with new high efficiency components nets a maintenance and reliability increase. The decreased down time from failures increases productivity and ensures students and researchers are provided with the best possible facilities for their research and teaching mission.
- Commissioning and improved occupant health - Dashboards and data monitoring installed as part of retrofits has enabled real-time commissioning and improved safety monitoring. UC Irvine's Smart Labs are using Aircuity Advisor to provide a dynamic set of information to take a proactive approach in protecting an energy savings entitlement, to aid in continuous commissioning, and to perform IEQ monitoring for a healthy, safe and productive work space.
- Sue and Bill Gross Hall, one of the labs included in the Smart Labs Initiative, received a LEED®Platinum rating for New Construction in December 2011.

Note: The UC Irvine data is a combination of metered data from variable frequency drives controlling equipment and building management system trends to create a model for building performance. This approach was used to focus on energy used by the building systems and exclude the energy used by laboratory process activities.

Annual Energy Use
(Source EUI)

BaselineCalculated(2008)
246 kBtu/sq. ft.

ActualCalculated(2012)
120 kBtu/sq. ft.

Energy Savings
51%

Annual Energy Cost

BaselineCalculated(2008)
$354,000

ActualCalculated(2012)
$174,000

Cost Savings
$180,000

Natural Sciences II

The “brain” of the Smart Lab system